(2)

1993
Executive Research Project
RS8A

Beyond "Integrated Weapon System Management"-- Acquisition in Transition

Lieutenant Colonel
John R. Ward
U.S. Air Force

Faculty Research Advisor
Dr. Robert E. Lyons

The Industrial College of the Armed Forces
National Defense University
Fort McNair, Washington, D.C. 20319-6000

REPORT DOCUMENTATION PAGE

1a. REPORT SECURITY CLASSIFICATION Unclassified	1b. RESTRICTIVE MARKINGS
2a. SECURITY CLASSIFICATION AUTHORITY N/A	3. DISTRIBUTION / AVAILABILITY OF REPORT Distribution Statement A: Approved for public release; distribution is unlimited.
2b. DECLASSIFICATION / DOWNGRADING SCHEDULE N/A	
4. PERFORMING ORGANIZATION REPORT NUMBER(S) NDU-ICAF-93- K38A	5. MONITORING ORGANIZATION REPORT NUMBER(S) Same
6a. NAME OF PERFORMING ORGANIZATION Industrial College of the Armed Forces 6b. OFFICE SYMBOL (If applicable) ICAF-FAP	7a. NAME OF MONITORING ORGANIZATION National Defense University
6c. ADDRESS (City, State, and ZIP Code) Fort Lesley J. McNair Washington, D.C. 20319-6000	7b. ADDRESS (City, State, and ZIP Code) Fort Lesley J. McNair Washington, D.C. 20319-6000
8a. NAME OF FUNDING / SPONSORING ORGANIZATION 8b. OFFICE SYMBOL (If applicable)	9. PROCUREMENT INSTRUMENT IDENTIFICATION NUMBER
8c. ADDRESS (City, State, and ZIP Code)	10. SOURCE OF FUNDING NUMBERS PROGRAM ELEMENT NO. / PROJECT NO. / TASK NO. / WORK UNIT ACCESSION NO.
11. TITLE (Include Security Classification) Beyond "Integrated Weapon System Management" -- Acquisition in Transition	
12. PERSONAL AUTHOR(S) John R. Ward	
13a. TYPE OF REPORT Research 13b. TIME COVERED FROM Aug 92 TO Apr 93	14. DATE OF REPORT (Year, Month, Day) April 1993 15. PAGE COUNT 54
16. SUPPLEMENTARY NOTATION	
17. COSATI CODES FIELD / GROUP / SUB-GROUP	18. SUBJECT TERMS (Continue on reverse if necessary and identify by block number)

19. ABSTRACT (Continue on reverse if necessary and identify by block number)

SEE ATTACHED

20. DISTRIBUTION / AVAILABILITY OF ABSTRACT ☒ UNCLASSIFIED/UNLIMITED ☒ SAME AS RPT. ☐ DTIC USERS	21. ABSTRACT SECURITY CLASSIFICATION Unclassified
22a. NAME OF RESPONSIBLE INDIVIDUAL Judy Clark	22b. TELEPHONE (Include Area Code) (202) 475-1889 22c. OFFICE SYMBOL ICAF-FAP

DD FORM 1473, 84 MAR 83 APR edition may be used until exhausted. All other editions are obsolete.

ABSTRACT

Integrated Weapon System Management (IWSM) is the management process and philosophy being implemented by the Air Force Materiel Command (AFMC) to manage AFMC's programs, product groups and materiel groups. The author reconstructs the technical, philosophical and historical genesis of IWSM then analyzes IWSMs usefulness in today's acquisition environment. Included are reviews of the advantages of IWSM, the challenges that remain in implementing IWSM and the applicability of IWSM for joint programs or in a joint acquisition command. Recommendations for improving IWSM and evaluation criteria for acquisition management systems are provided.

1993
Executive Research Project
RS8A

Beyond "Integrated Weapon System Management"-- Acquisition in Transition

Lieutenant Colonel
John R. Ward
U.S. Air Force

Faculty Research Advisor
Dr. Robert E. Lyons

The Industrial College of the Armed Forces
National Defense University
Fort McNair, Washington, D.C. 20319-6000

DISCLAIMER

This research report represents the views of the author and does not necessarily reflect the official opinion of the Industrial College of the Armed Forces, the National Defense University, or the Department of Defense.

ABSTRACT

Integrated Weapon System Management (IWSM) is the management process and philosophy being implemented by the Air Force Materiel Command (AFMC) to manage AFMC's programs, product groups and materiel groups. The author reconstructs the technical, philosophical and historical genesis of IWSM then analyzes IWSMs usefulness in today's acquisition environment. Included are reviews of the advantages of IWSM, the challenges that remain in implementing IWSM and the applicability of IWSM for joint programs or in a joint acquisition command. Recommendations for improving IWSM and evaluation criteria for acquisition management systems are provided.

FOREWARD

This paper is written for those in the warfighting arena who have and will fight valiantly for freedom. From the first concept of a weapon through the instant the trigger finger sends it to its target the motive to restore or preserve freedom must prevail or all the effort will be for naught.

I owe a special thanks to Terri for her continued support during this project. To Keva, Byron, Kyle, Tyson, Jeffrey and Stephanie I thank you for your patience and sacrifices.

A special thanks goes to Dr. Robert Lyons who gave me the desire to keep digging deeper and then provided the hope that there was a way to climb out!

Without the many kind contributions of time and thought from the people listed below my understanding of Integrated Weapon System Management would be limited. I am grateful for each of their contributions.

NAME	ORGANIZATION	INTERVIEW
M/Gen Stephen P. Condon	SAF/AQX	Apr 93
M/Gen Charles E. Franklin	SAF PEO for Tac Aircraft	Oct 92
M/Gen Stephen P. McElroy	SAF PEO for Tac Weapons	Oct 92
Col. Frank Anderson	AGM-130 Program Manager	12 Nov 92
Col. Tom Devenny	Joint Tactical Systems SPO	12 Nov 92
Col. Mike Harrison	Program Manager JDAM SPO	12 Nov 92
Col. Mary McCully	ICAF Faculty	Mar 93
Col. William D. Rutley	Arnold Eng. Dev. Center	11 Feb 93
Col. Riley Shelnut	Air Force Dep., AMRAAM SPO	12 Nov 92
Col. Daniel Tibbets	AFMC/Seek Eagle Office	13 Nov 92
Col. John Warner	AFMC Range Systems SPO	13 Nov 92
Lt. Col. Rich Bowman	AFMC/XR-WS	23 Jan 93
Lt. Col. Bill Broome	AFMC/Seek Eagle Office	13 Nov 92
Lt. Col. Bernie Carey	AMRAAM Chief of Test & Int.	12 Nov 92
Lt. Col. Charlie Craw	AMRAAM SPO	12 Nov 92
Lt. Col. Scott Gordon	SAF/LGXX	1 Mar 93
Lt. Col. Greg Hughes	SAF/AQXA	18 Jan 93
Ms. Kaye Brewer	SAF/AQXA	23 Jan 93
Ms. Sandy Brown	Joint Tactical Systems SPO	13 Nov 92

BEYOND "INTEGRATED WEAPON SYSTEM MANAGEMENT"

-- ACQUISITION IN TRANSITION

by

Lt Col John R. Ward, USAF

On 1 July 1992 the Air Force Materiel Command was created to take the place of Air Force Logistics Command and Air Force Systems Command which were deactivated. Integrated Weapon Systems Management is the management process designed to enable AFMC's program, product and materiel teams to accomplish their missions.

PROLOGUE - SETTING THE STAGE

The fresh morning air had a tenseness rarely felt in the Florida panhandle. It would be an historic day. For three men the pressure of the day in May 1990 was exceptionally intense. This day would bring each of them either one of the greatest disappointments or exhilarations of their lives when an F-15 "Eagle" loaded with four Advanced Medium Range Air-to-Air Missiles or "AMRAAMs" took off from Eglin Air Force Base and attempted almost simultaneously to launch the AMRAAMs against four targets over the Gulf of Mexico.

The three men with a lot on the line were Brigadier General Charles Franklin, the AMRAAM program director; Lieutenant Colonel Chris Caravello, the AMRAAM Chief of Test; and Captain Ben Joplin, the F-15 test pilot. The test was the culmination of years of complex engineering tasks that integrated new technology into the

missiles and mated the AMRAAM with the F-15 in order for the total weapon system to accomplish this spectacular feat.

Still too recent in their memories was that disastrous day, 2 August 1989. That was the day four AMRAAMs shot from the F-15 test aircraft all splashed -- into the Gulf of Mexico after missing the intended targets. The first missile was fooled by the target aircraft; a fairly simple missile software update was the only correction needed to fix the problem. The other three AMRAAMs all tracked right to where the F-15 radar told them to go. The problem was that the F-15 told them to go to the wrong place; the F-15 radar wasn't capable of deciphering the complex ECM environment it was painting and integrating the information so that the AMRAAMs could find and track their intended targets. This problem took over 50 F-15 radar software updates to correct before the radar could accurately process the data required to fire the AMRAAMs.

But now the long-awaited chance to even the score had arrived. Today's mission was especially critical since a second failure of this test, coupled with other program problems, could leave those who opposed the AMRAAM program with enough ammunition to make an AMRAAM kill of their own!

Officially the mission was referred to as "4 Missiles vs. 4 Resolved Targets in Complex ECM" environment. The purpose of the "test was to demonstrate AMRAAM's ability to achieve multiple near-simultaneous kills against multiple targets when launched from an F-15, despite attempts to confuse the missile and aircraft guidance systems through electronic countermeasures."(A:15)

AMRAAMs were launched from 15,000 feet by Captain Joplin after the F-15's radar painted four target aircraft (drones). "The F-15 was flying at a speed of 650 knots, nine-tenths the speed of sound,

when the missiles were fired. The four oncoming target drones also were traveling near the speed of sound, but at lower altitudes. Additional 'enemy' aircraft were in the vicinity, attempting to confuse the F-15 and AMRAAMs' radar guidance systems through electronic jamming. The first two AMRAAMs were launched at targets flying at an altitude of 10,000 feet, the second two at targets flying at 5,000 feet. This second pair of targets also carried onboard jammers as an additional challenge. Despite the jamming, all missiles guided successfully. Three missiles scored direct hits, while the remaining missile passed within lethal distance of the target."(A:15)

Seconds after the last missile was fired from the F-15, Joplin performed evasive maneuvers to leave the fight before the targets were hit. This "launch and leave" maneuver was possible because the F-15 radar and central computers had handed off information and responsibility for mission success to the AMRAAM's own active radars.

So What? - Is this better than Ling Ling and Tsing Tsing?

Has weapon system integration increased in importance enough to make it the central focus of the weapon system acquisition management processes of the future? In a word, yes! The successful mating of the F-15 and AMRAAM portends the technological fusion wave of the future in weapon systems acquisition. One need only speculate about other new systems to understand the increased complexity in integrating weapon systems.

To exploit the full range of possibilities provided by the NAVSTAR Global Positioning System (GPS) satellites a lot of "integration" had to occur. The satellites were built, then mated

with launch vehicles that sent them into orbit. Ground stations essential for determining the position of the satellites had to be integrated as a key part of the entire system. But all this was not enough. Almost every frontline U.S. ship, aircraft, tank, or vehicle was modified to use the capability.

Even personal packs were built so individual soldiers could exploit the information provided by the NAVSTAR GPS system. Many American soldiers using the packs in Desert Storm knew their position in the desert better than Saddam Hussein's native Iraqi soldiers. If NAVSTAR GPS data had not been made available to these users, most of the capability of the NAVSTAR GPS system would have been wasted.

Even the top levels of our government have recognized that new technological capabilities with military applications don't count for much unless they are integrated with other capabilities already available. The January 1993 national security strategy published by the White House called not only for restructuring within the Defense Department but for continued exploitation and better integration of technological opportunities such as "advanced sensor and other surveillance and reconnaissance systems, communications, as well as precision lethal and non-lethal weapons."(L:19)

The future success of weapon system acquisition will certainly be tied to dynamic marriages between systems that exploit the newest technological breakthroughs. Being able to fuse the ideas and produce lethal offspring faster than our enemies will be a key underpinning for a successful national security strategy. One can only imagine the power that future systems can have. The power will reside primarily in fused information gathered from multiple sources.

In the "Gulf War, a single strike airplane carrying two 'smart' bombs could function as effectively as 108 World War II B-17 bombers carrying 648 bombs and crewed by 1080 airmen."(N.M.:31) Imagine the capabilities of "smart weapons" such as cruise missiles made even smarter when provided data from many sources of information. Inputs from numerous airborne, ground-based, space-based and/or sea-based data sources in multiple spectral bands could be fused to provide a weapon anything required to complete its mission(s). Precise military objectives may be reachable with extremely high probabilities of success if these capabilities are effectively integrated. As technological complexities of weapon systems exponentially increase, the capability to manage the integration of these new technologies into lethal, dependable weapon systems will likely determine the winners of future conflicts.

Clausewitz called intelligence "every sort of information about the enemy and his country."(R:117) Today's technology could give us the ultimate intelligence required to follow the dictum of Sun Tsu to know our enemies and know ourselves to find success in war.(Q:61) In the future we may have the capability to tell an inbound weapon system more about enemy threat systems than the enemy knows about his own forces! But it all depends on our ability to integrate weapon systems by fusing new technological capabilities. Disaster surely awaits us if we don't.

The requirements to integrate weapon systems more effectively and conduct weapon system program management processes more efficiently underscored the major reasons Air Force Materiel Command was formed.

INTRODUCTION

On 1 July 1992 the Air Force Materiel Command (AFMC) was born. Gently laid to rest were the Air Force Logistics Command (AFLC) and the Air Force Systems Command (AFSC) -- two organizations responsible for developing, producing, supporting and bringing to the Desert Storm skies the greatest airborne firepower ever used in war. Less than 18 months after the conclusion of Desert Storm those great resource commands were combined. At the heart of the new Air Force Materiel Command was a new management process -- Integrated Weapon Systems Management -- that holds promise for improved efficiencies in the management of resources for future conflicts.

In this paper I will:

(1) expand on the technical challenges IWSM must solve to be considered successful -- weapon system integration.
(2) examine the IWSM philosophy, history, and concepts.
(3) evaluate the positive and negative aspects of IWSM.
(4) provide my views on what still must be completed to fully implement IWSM.
(5) discuss how IWSM can be applied to joint programs.
(6) discuss how IWSM would be used in a consolidated DoD acquisition command.
(7) present some concluding thoughts.

There are some basic questions that should be asked concerning IWSM. Is it a valid management system for managing the acquisition of military weapon systems in the current environment? If so, what should be done to make it even better? Is the IWSM philosophy applicable to a joint environment? If the Department of Defense acquisition system is changed soon are there key elements of IWSM that should be built into the new structure?

WEAPON SYSTEM INTEGRATION - THE SCOPE OF THE CHALLENGE

In explaining the underlying reasons for creating AFMC, the HQ AFMC (Provisional) Commander, Major General Kenneth Meyer stated,

"(E)verywhere we looked, however, we did find that the pendulum in weapons acquisitions is swinging back towards tighter integration of the entire process, and one key reason is that the weapons themselves are becoming more tightly integrated."(B:68) To evaluate the effectiveness of IWSM in AFMC we must first understand the complexities of the integration process.

Weapon system integration means many things to many people. Conceptually integration has changed from putting weapons onto aircraft to integrating them into aircraft. The technical processes to accomplish this integration should be understood before we evaluate the management structure used to control those processes. From the technical side **basic integration** is mating subsystems (weapons, engines, radars, etc.) with a platform (aircraft, tank, satellite, ship, etc.) to form a total weapon system. At the next level is **integration across systems** or adapting a subsystem (e.g., AMRAAM) to a platform(s) (e.g., F-15). Greater integration levels not often discussed are **mission area and force package integration** which concern the integration of weapon systems with other weapon systems into combat mission elements. I'll expand on the concepts behind each of these integration levels.

Basic Integration

Integrating the AMRAAM with the F-15 was difficult. In order for the total system to accomplish its mission several hard things had to be done. These tough tasks included ensuring the F-15 software and AMRAAM software were compatible and the AMRAAM could survive the carriage and launch environment of all applicable F-15 operational conditions. Key technical problems resulted from electromagnetic forces, acoustics, G-loading, missile carriage impacts on

aircraft stability, missile stability impacts from the engine and aircraft environment, and many more. The complexity of the software problem alone was staggering. The F-15 radar, weapon launch computer (PACS -- Programmable Armament Control Set), electronic counter-measures system and the central computer that ties all the systems together each have separate software and hardware. They each have crucial data that must be accurately passed before launching each AMRAAM, sometimes into a supersonic environment -- an environment that can become a timeless tomb to pilots who squander nanoseconds or bite on bits of bad data.

The AMRAAM is just one of many subsystems that must be sculpted into the F-15 if it is to soar like an Eagle! The engines, air-to-air radar, radar warning receiver (RWR), navigation equipment, defensive-countermeasures equipment and many other weapons and avionics subsystems must be successfully knit together if F-15 aircrews are to control the skies. The complexity of this basic integration task rises exponentially when multiple weapons and targeting pods are carried on multi-role aircraft like the F-16 -- an aircraft that can carry over 40 unique subsystems.

There is a subtle, but very important, management implication that comes out of the basic weapon integration tasks. Because the aircraft is the host for multiple subsystems, a hierarchical order among program offices is necessary with the aircraft program offices given "oversight of subsystems" that flow to them.(F:1) Even among the subsystems there must be some interleaving of program offices depending on which system may incur the highest cost in dollars or lost technical capability to change when tradeoff decisions between subsystems are necessary.

Integration Across Systems

To the program manager of weapons the integration task is far more complex than just trying to adapt the weapon to one type of aircraft. For example, the AMRAAM program manager must build a flexible interface that allows the AMRAAM to be carried and fired from the F-14, F-18, German F-4, sea-Harrier, all models of the F-16 and F-15, and eventually the F-22. This can become an extremely complex task. On the F-15 alone the F-15A/B and F-15C/D models each have unique software versions for their radars, central computers and weapons control sets. These software packages are continually being improved and updated with new releases usually scheduled annually!

Integration across systems is not unique to the Air Force. For example, the Harpoon was planned for installation in sixteen classes of U.S. Navy surface ships ranging from patrol hydrofoils to nuclear-powered strike cruisers.(OO:1) The complexities of interface matching can go up exponentially when multiple systems are involved.

Perhaps an example can underscore why this kind of integration is so important -- with many ramifications in system costs and technical capability. In 1985, Air Force leaders selected the High-Speed-Antiradiation-Missile (HARM) for carriage on the F-16 for the purpose of destroying enemy radars at surface-to-air-missile (SAM) sites. This "weapon system marriage" was proposed because the Navy and Air Force had already developed the HARM for other aircraft. The new marriage nearly ended in divorce! The cause was incompatible software.

The interface "seam" that integrated the F-16 and HARM was a two-by-eight foot electronics box called the HARM Launcher-Avionics-Package (LAP). The HARM LAP was an innovative method of cutting costs and integration time by using a software solution. The HARM

LAP transformed F-16 software originally developed for the F-16 Maverick missile marriage into a message usable for launching HARMs. The HARM sent signals to the F-16 via the LAP which passed it on to the F-16 Maverick software when it was ready for launch. In effect, the electronics box helped the F-16 and HARM partners lie to one another to get the other partner to perform as desired!

Even a novice weapon system integrator could tell this had the makings of a bad marriage. The false signals slowed communication, "ghost" impulses were given to phantom Maverick missiles, and the two-by-eight foot LAP stranger in the marriage made the F-16 HARM honeymoon a disaster. But for an interim period it provided the Air Force much needed, albeit degraded, capability for F-16s to launch HARMs. Fortunately the integration team eventually had more time to remedy the original quick integration fix and developed seamless F-16 and HARM software versions that handled HARM launches much more effectively, dramatically increasing capability. The marriage was saved and the black-box interface (LAP stranger) was no longer needed after seamless compatible software was developed.

Mission Area/Force Package Integration

The integration of force packages is done at several levels. Ideally it would first be done as part of the weapon system acquisition process to determine if the new weapon systems being purchased complement the other weapon systems that will be used against our adversaries. For example, if the EF-111 had to be replaced, analysis should be conducted to determine the required amount of standoff jamming future force package leaders require to help them evade enemy defensive electronic systems.

Analysis of each set of force packages United States forces are likely to use in future conflicts represents the broadest scope of force integration. This should be done as part of the mission area analysis process which identifies **broad mission area requirements** and again as new systems are recommended for approval in the acquisition review process to identify **specific weapon system requirements**.

The next level of force package integration is accomplished by operational commanders when units are formed or restructured and unit missions are defined and accepted. The Air Force creation of composite wings is designed to integrate flying units more closely with the air, ground and support units they will go to war with.

The final integration phase ultimately occurs when aircraft tasking orders are drawn up assigning force packages to targets or missions. Assets made available by our acquisition system, organizational assignments, and current theater deployments are molded into force packages designed to defeat the enemy. Mission commanders and individual aircrews complete the integration cycle by combining the capabilities of all the weapon systems available to them and employing tactics against their adversaries.

Sun Tzu said a "speedy victory is the main object in war."(Q:97) In future wars, speed will be of supreme essence. Anything we can do with technology to shorten the decision-making time will save lives. This is true for an F-15 driver in a tactical dogfight or a missile shootout at 20,000 feet. It is also true at the strategic level as we design management systems that prepare us to bring combat resources to operational theaters more quickly than our enemies. The Integrated Weapon Systems Management philosophy

adopted by AFMC can do just that. Its success or failure will likely determine if we get to the battle in time and with the right combat resources to win. The resources available to the theater commanders will ultimately drive the strategy and tactics they employ.

IWSM -- SO WHAT IS IT ANYWAY? -- THE BACKGROUND

The creation of AFMC on 1 July 1992 involved over 20% of the people in the Air Force and over 40% of the civilians.(B:66) It also meant that over 50% of the Air Force's total budget would come under AFMC. It was the largest financial asset merger in history! In all, AFMC now controls over $160 billion in assets with a workforce of 128,000.(C:9) Significant problems could be anticipated with a merger of this size in a period marked by significant pressure to decrease the military and civilian forces. The most difficult problem would be successfully merging two distinct cultures. Cultural differences were cited over and over again by those I interviewed as a major AFMC hurdle loaded with "huge emotional issues."

According to senior officers who have served in both commands, the unique cultures stemmed from differences in command missions and methods of funding those missions. AFLC was charged with supporting fielded weapon systems and was funded by operations and maintenance budgets that had to be justified annually -- primarily through services to operational commands. Therefore AFLC focused on long-term efficiencies that resulted mainly from controlling life-cycle costs of weapon systems. This was accomplished through efficient management of spare parts, commodities, inventories, and overhead expenses; and through better maintenance practices.

There was also some recent "culture shock" induced into the Air Logistics Centers or depots by the 1989 Defense Management Report.(Y:51) Under the new guidance they will have to compete for the business that comes to them and operate more like private contractors.

The AFSC culture was oriented to quick action in providing new products and capabilities to the operational commands. Some program managers resisted worrying about long-term support costs because they didn't have to pay for them from their budget and they were immersed in development, production, budget and political issues impacting their program. Therefore supportability issues often received second priority. Moreover, individuals within the two commands often had disagreements concerning programmatic issues. Although program managers were expected to address support issues during weapon design and production phases the program manager didn't have responsibility for long-term support of the weapon system. When it was time to make requirements tradeoffs it was easy to forget about support issues. Someone in AFLC could worry about support! And AFLC often got stuck paying the support bill for a system that was not built for support.

The net result was that AFLC became a command with centralized controls supported by well integrated information systems that provided efficiencies in controlling resources. AFSC became a decentralized command that emphasized bringing new technologies to the operators as quickly as possible.

The current DoD budget drawdowns are likely to have a dramatic affect on merging these diverse cultures. Communities that have long jousted over resources and missions are now on the same team, sharing a much smaller total budget pie. What it means at the worker level is that you are now asked to cooperate and work closely with people

who may be subtly competing with you for the (decreased) future work. The ultimate success of a program manager implementing IWSM will be his ability to form a "partnership between the acquisition and sustainment" people supporting his program.(G:16)

The IWSM Philosophy

IWSM is more than a management system -- it is a leadership philosophy(C:13) designed to merge the two distinct cultures from the old commands into a unified culture, with people committed to finding better ways to develop, acquire, test and sustain weapon systems. At the same time IWSM is a leadership commitment extended to AFMC people for them to grasp the trust, teamwork and continuous improvement opportunities that allow them to make more capable and supportable weapon systems.

In short the motive behind IWSM is "empowering a single system program director with authority over the widest range of program decisions and resources to satisfy customer requirements throughout the life cycle" of a program.(JJ) This philosophy entails three philosophical tenets and seven principles designed to support those tenets. Implementing IWSM also entailed redefining and integrating eight core processes.

Even though this paper focuses on program managers and their role under IWSM, it should be noted that product group and materiel group managers in AFMC are operating under the IWSM philosophy as well. This paper zeroes in on the program manager's role because it was the initial IWSM target. In November 1992 an "Integrated Weapon Systems Management Model for Single Managers in AFMC" white paper was released in AFMCR 500-11. The paper extended the IWSM philosophy to all AFMC single managers of systems, products and materiel.

Cradle to Grave Management. This leadership tenet is based on the premise that one leader and her team should have the authority and responsibility for a weapon system program. The scope of this task should start at the beginning of a system's life, not later than Milestone I, and continue through the retirement of that system. "This ensures that management considers the impact of its decisions not only on development activities, but also on the operational phase, which can span several decades."(G:96)

With one team responsible for the entire system, decisions that favor long-term solutions instead of short-term work arounds should be the norm. In short, an **integrated product team**, led by one program manager helps get the right people in the right place(s) at the right time so right decisions can be made.(C:29)

Although IWSM originally focused on acquisition programs, the IWSM concepts are now being adapted for product and materiel managers who have broad scopes of responsibility within AFMC.(LL)

Single Face to the User. This tenet stems from the desire to provide AFMC customers with a single united, responsive team that can interact with and respond appropriately to their requirements. A single organization led by one individual should be accountable to the customer.(G:96) In the past the user had "two guys to deal with, and the industry folks (had) two separate folks to sell to."(B:68) Previously this forced a lot of the management integration responsibilities on the customer, as he tried to ensure that applicable weapon system updates were synchronized.

Although the "make-up of the organization will change over time and elements will likely be at multiple locations" the program management responsibility will always reside in the hands of a single system program director.(J:4-5)

Seamless Processes. The purpose of this tenet is to ensure we accomplish at the management level the same objectives we subscribe to at the technical level -- making sure there aren't any cracks that customer weapon system requirements can fall through. In order for this to occur, critical valid processes must be developed and carried out that don't omit key acquisition tasks.(G:96) Some of the seams of concern include:

- User, program office, support office and contractor(s) not understanding or omitting requirements.
- Headquarters staff agencies (SAF AQ & FM, HQ USAF XO & LG) not working together to provide straightforward program direction and funding.
- Integration between subsystem (weapon, engine, etc.) and platforms (F-15, M-72, Trident, etc.).
- Communication between customer, acquisition team and test community.

NOTE: Before AFMC, program management responsibility transfer (PMRT) from AFSC to AFLC was a real problem area. A program in production may have been ready for PMRT from AFSC's view but still require major development updates to be fully supportable and/or compatible with its host platforms.

The IWSM tenets and supporting principles are intended to close any seams likely to result in user needs not being met. These concepts are revolutionary and fundamentally underpin the business practices developed in AFMC.(G:96) They are also the key factors counted on to help the new command succeed. The last commander of AFLC, General Charles McDonald, claimed the single-manager approach would strengthen reliability and maintainability "initiatives by eliminating cultural differences that existed between the research and development and logistics communities in years past."(U:58)

Supporting Principles. Principles that support the IWSM philosophy include:(J:5-9)

- Increasing the system program director authority.
- Creating a single business decision authority.
- Creating a technology insertion process to upgrade existing weapon systems, improve depot competitiveness and redress environmental issues.
- Creating integrated product development teams.
- Maintaining management continuity.
- Building new partnerships.
- Consolidating the Air Force acquisition process to include all weapon and communication/computer system and support programs.

Eight Core Processes. Eight core processes were analyzed and modified during the IWSM development phase for implementation. They were considered the minimum processes to be reviewed by IWSM programs but were not intended to limit programs from reviewing additional processes that impacted them. The core processes were:

- Logistics
- Financial Management
- Technology Management
- Test and Evaluation
- Contracting
- Program Management
- Requirements
- Systems Engineering and Configuration Management

The IWSM History

The drive to consolidate AFLC and AFSC into Air Force Materiel Command led to the creation of IWSM as the core philosophy that would propel the new command. IWSM was referred to as the "cornerstone of the merger."(U:58) In setting up AFMC Dr. Donald Rice, Secretary of the Air Force (SECAF), and General Merrill McPeak, the Chief of Staff of the Air Force, stated in a joint memorandum that the "principles, processes and products of IWSM will keep the Air Force on the leading edge, ready to take on the security demands of a new era."(II:1)

Major IWSM Events

- Late 1989 - Air Force officials rejected initial push for merging AFLC and AFSC, "arguing that streamlining of the commands might be enough to avoid consolidation."(T:64)

- 10 Jan 1991 - SECAF directed integration of AFLC and AFSC with charter to improve vital research and development, modification, maintenance and long-term support processes.

- April 1991 - IWSM study team is launched and first 16 programs selected to establish the IWSM process.(T:64) They were grouped according to how quickly they could start to implement the IWSM concepts:
  - -- Group 1: NAVSTAR GPS, E-8 Joint-STARS, B-1, life support systems, AGM-65 Maverick, and F-15
  - -- Group 2: F-111, FPS-124 Ground Based Radar, E-3 AWACS, electronic warfare and LANTERN
  - -- Group 3: ICBMS, automated test equipment, F-16, B-2, F-22

- 25 June 1991 - AFLC and AFSC commanders issued clarifying guidance stating that IWSM programs transfer to the logistics centers when they are "mature."(II) A letter also specified the role of the labs, commodity managers, configuration control, and program manager business decision authority.

- 30 July 1991 - SECAF announced transfer of acquisition programs from Air Force Communications Command (AFCC) to AFMC, effective July 1992 for acquisition and January 1993 for support elements. This resulted in five more programs being added to the initial 16 IWSM programs.(X:4)
  - -- Group 4: SCOPE Command, Integrated Base Information Digital Distribution System (I-BIDDS), Wing Command and Control System (WCCS), Combat Ammunition System (CAS), Core Automated Maintenance System (CAMS)

- 20 November 1991 - AFLC and AFSC Commanders signed agreement designating Commodity Support System Manager responsible for addressing all logistics areas for the program director.(JJ)

- 13 August 1992 - SECAF Donald Rice delegated sustainment and readiness activities to the Chief of Staff of the Air Force. The impact for IWSM was that development and procurement activities would remain the responsibility of the SECAF and be accomplished through the Service Acquisition Executive (SAE) while the sustainment activities would be handled through the Chief of Staff and accomplished under the guidance of the logistics staff in the Pentagon. This meant that while the readiness and sustainment functions would be combined under a single program manager in AFMC she would have two Air Force staff agencies in the Pentagon giving guidance to her.

- January 1993 - General Yates, AFMC Commander, and Lt. General Jaquish, the acting Air Force Aquisition Executive, designated 79 follow-on programs or program groups to begin IWSM. Just 31 programs remain to start IWSM.(C:21) IWSM programs are now tracked in four categories:
  (1) PEO/DAC aircraft programs
  (2) PEO/DAC non-aircraft programs
  (3) Product groups
  (4) Materiel groups

- April 1993 - IWSM Program Master List was approved by SAF/AQ.

IWSM - DOES IT HOLD WATER? - CONCEPT VALIDATION

The U.S. military-industrial system has led the world in developing and applying new technology since we fully committed ourselves to help win World War II. The success of superior U.S. technology in helping bring successful conclusions to the Cold War and Operation Desert Storm is broadly acknowledged. Both AFSC and AFLC were key actors in preparing our forces for those past successes. AFMC has much at stake and must ensure IWSM helps AFMC fulfill its acquisition and sustainment leadership roles in future conflicts. Fortunately our recent victories have bought us some time to reexamine how we can best establish ourselves for new challenges.

The January 1993 national security policy issued by the White House states that "[w]e must complete the process of streamlining and restructuring U.S. government institutions" by examining duplication of activities and agency structures.(L:11) Likewise, in discussing the future of American industry the National Research Council stated that "[a]s new manufacturing technologies are more widely adopted in the years ahead, the most important factors in improving responsiveness, flexibility, costs and quality will be the effectiveness of <u>management practices</u>, of <u>organizational design</u>, and of <u>decision-making</u> criteria."(D:315) [Author's emphasis added.]

The IWSM philosophy will drive AFMC's culture, management practices, organizational design and decision-making methods. Ultimately AFMC's effectiveness in providing many of the weapon systems needed to defend the U.S. in the future will be determined by the success of IWSM.

Advantages of IWSM

IWSM Philosophy. The people I interviewed overwhelmingly supported the IWSM approach. Their criticism of IWSM only reflected their dissatisfaction in being able to implement the IWSM philosophy more effectively and more rapidly. They ardently agreed on the value of the single manager concept.

Compatibility with Trends in Industry. Success of a military acquisition organization in the post-Cold-War environment will largely be determined by the compatibility of that organization with its primary "suppliers" -- American industry. The economic problems of American businesses over that past decade and the recommended business strategies to cure those problems indicate that fundamental shifts in U.S. business practices are required. Some have claimed that American corporations "will have to make far reaching changes in the way they do business. They will have to adopt new ways of thinking about human resources, new ways of organizing production systems and new approaches to the management of technology."(D:125)

The non-traditional economic recovery from the 1990 - 1992 recession is a clear indication that many firms are already changing their competitive approaches. It is imperative that defense acquisition organizations, long the managers of improved technology, should also change in order to better accomplish their missions.

AFMC's primary acquisition process to interface with industry in this new environment is centered around IWSM. The essential question is whether IWSM is an appropriate method to acquire military resources given these trends in industry and the likely strategies that will be used by corporate America in the near future. Following are potential strategies for rebuilding American industry:(D:148-50)

- Focus on improving the long-term quality and efficiency of the production process. Firms should be able to **adapt rapidly** to market conditions and to deliver high-quality products quickly at competitive prices.
- Design products for manufacturing and **build quality in during the design stage.**
- **Integrate** and perform concurrently the functions of **research and development, product design, and process design** to achieve greater efficiency and a **shorter time to market.**
- **Cooperate with suppliers** rather than treating them as adversaries.

Management of military programs under IWSM principles is fundamentally consistent with the strategies proposed for U.S. industries. Having one team responsible for all aspects of a program promotes designing in characteristics that improve the long-term quality, cost and performance of weapons.

Additionally, if threats to U.S. security require an immediate development and fielding of new weapon systems, a tightly knit IWSM program team, armed with greater decentralized decision-making powers, can rapidly respond with the private sector in bringing new technological capability to future battlefields. The capability to have faster research, design, and production turnaround times in fielding new technology would be extremely important for our military readiness just as it currently is for our economic competitiveness in the private sector.

One other key IWSM characteristic that has a link to some of the best management trends in industry is the added authority given to

the program manager. Many of the best Japanese firms that depend on exploitation of research and development breakthroughs have a "heavyweight" program manager assigned to resolve "conflicts about objectives and roles at the outset of product development."(D:70) Certainly the strong program manager role under IWSM with the major program managers enjoying direct access to the Program Executive Officers (PEO) and Air Force Acquisition Executive (AFAE) enable the growth of "heavyweight" program managers where needed to develop and field the most needed new systems responsively.

Applicability in Current Acquisition Environment. Throughout the 1992 presidential campaign President Clinton called for a future defense based on (1) laying out a clear plan and budget for acquisition of new weapon systems, (2) shaping the industrial base to support future security capabilities, (3) focusing efforts to maintain our lead in research and development of technologically superior weapons and (4) making better decisions about the systems we buy.(K:22) These basic ideas say much about how the Department of Defense (DoD) is expected to operate in the foreseeable future -- at least until major changes in the international situation occur.

It is not inconsequential that President Clinton's ideas closely parallel those expressed by the new Secretary of Defense, Les Aspin, who called for a four part acquisition strategy while he was still Chairman of the House Armed Services Committee. That strategy was based on (1) **selective upgrading** -- maintaining critical portions of the industrial base by upgrading existing systems, (2) **selective low-rate procurements** -- keeping other vitally needed suppliers "alive," (3) **rollover-plus** -- prototype new systems and then improve on those systems without producing them except when stringent criteria are met

and (4) **silver bullet procurements** -- procure systems where a high-tech advantage could maximize our leverage.(P:16-23)

Other current national concerns involve efficient conversion of the defense industry to the commercial business sector. Last year a U.S. House of Representatives plan for conversion of the defense industrial base stressed the need to "stimulate growth by encouraging cross-fertilization between DoD and commercial high-tech firms."(AA:8)

Implementation of IWSM places AFMC in a position to respond aggressively to the less robust acquisition environment created by the strategy of the new administration and the "heavyweight program manager" practices observed by successful Japanese firms. Having a single manager responsible for all aspects of a program should improve the focus given to technological insertion opportunities in new and old systems. The IWSM program office can also balance the cost of investing technology to upgrade weapon systems with the long-term support costs of those systems and know what the cost tradeoffs are before investing in these new capabilities.

Integrated Product Development. "Approximately 85 percent of the total life-cycle-cost of a weapon system has been committed, through the design of the system, by the time full-scale development begins."(H:222) A key reason IWSM has so much potential to make huge payoffs in acquiring new weapon systems is that the people charged to determine maintenance support concepts are now on the same team as the acquisition manager. A single program manager who controls all DoD personnel directly responsible for acquiring and sustaining a weapon system is in a very strong position to make sure the right tradeoffs are made early in the development cycle. She can also

ensure concurrent engineering places support characteristics in the design when its still relatively inexpensive to change.

The industry side of a program team is where most technological breakthroughs occur. But this side is not without its problems. "Nearly one-third of U.S. scientists and engineers [are] employed in military work, but even within the same company, scientists and engineers in the commercial and military divisions may not communicate well or at all."(BB:xi) Last year in a report the Center for Strategic & International Studies stated that "in most companies defense products are designed, developed, produced, and supported separately in isolated plants or independent divisions."(BB:x) In the past this has sometimes meant that the military side of industry was further fragmented into new product development and product support divisions.

This fragmentation on the industry side mirrored the fragmented oversight responsibilities of the Air Force that were divided between AFLC and AFSC. The single manager concept in AFMC should make it easier for the industry to be responsive to development and support requirements -- with only one Air Force team to coordinate with. General Ron Yates, AFMC Commander, recently told a group of defense contractors that AFMC expects them "to combine the development and support side" of their companies forming Integrated Product Teams to do business with AFMC.(RR)

Flexibility. In discussing the "smart infrastructure" that will move the "information and materiels with speed, flexibility and accuracy," Dr. George Koznetsky observed that these infrastructures require the "linking of talent, technology, capital and know-how ... and emphasize the importance of ... networks of scientists and

technologists.(W:1) Certainly IWSM links the main players on a program team together even though almost all IWSM teams will have people residing at separate locations. IWSM also provides for speed and flexibility in decision-making with the user since one management team with total system oversight can more readily make tradeoffs between cost, schedule, performance, and support.

Previously IWSM users often faced the difficult task of coordinating program actions between AFLC, AFSC and contractors. For instance, McDonnell Douglas was developing new software for the F-15E and updated software for the F-15C/D radar, weapons control set, central computer and ECM gear simultaneously while the Warner Robbins Air Logistics Center was doing the same thing for F-15A/Bs. Meanwhile, if a new weapon(s) like AMRAAM was being developed for the aircraft, the F-15 program office and the weapon program office would be charged with trying to dovetail the interface software for the new weapon into numerous F-15 software packages being handled separately by McDonnell Douglas and the Warner Robbins ALC. For the F-16 this problem was exacerbated by "blocks of aircraft" with different computer capacities being fielded and developed concurrently!

An IWSM initiative to hold Weapon System Reviews between users and the weapon and aircraft program offices is addressing these concerns. Turf battles are being replaced by integration issues that the collective Weapon System Review team collectively works.

Another area requiring much flexibility is determining the needs of our future industrial base. Manufacturing suppliers within the defense industrial base declined from 118,000 in 1982 to 38,000 in 1991.(I:161) Under IWSM the responsibility to ensure that the future industrial base is capable of sustaining a weapon system will rest squarely with the program manager.

Flexibility also describes the American manufacturing industry which is rapidly retreating from being high-volume based to being high-value based.(E:82) For instance, McDonnell Douglas buys composite helicopter blades comprised of 17 different materials at a cost of over $50K each. The ability to produce high-value items will determine the competitiveness of American firms in foreign markets.

Many of the high-value items being produced today rely on good software to function effectively. In 1984 80% of the cost of running a computer was tied to hardware costs and 20% was in software. By 1990 these figures were reversed. We should anticipate that future military struggles may also be based upon the ability to quickly produce high-value systems controlled by software.

The IWSM single manager and cradle-to-grave management concepts place AFMC in a strong position to help American industry respond rapidly by having one focal point for weapon system hardware and software requirements. This approach avoids fragmenting responsibility over time as systems mature.

Responsiveness to User. The ability to provide military operators with needed capability in a timely manner has always been the bottom-line success criterion for military procurement. In an environment marked by exponentially increasing technological capability, responsiveness to user needs is extremely important. It has been stated that "[T]oday and in the future, effective use of new technology will require people to develop their capabilities for planning, judgement, collaboration, and the analysis of complex systems."(D:135) The **single-face-to-the-user** concept administered by one program team responsible for **cradle-to-grave management** of new capability for the operators places the team in position to

field new capability aggressively when the user needs it. Failure to do so would clearly be the fault of the program management team.

Prior to IWSM, fragmented responsibility spread across two "resource providing" commands (AFLC and AFSC) could leave the user as a spectator in a fingerpointing game ... and virtually helpless in getting what he needed. The user could find himself in the difficult position of having to knit together the bare threads of capability offered from each of the resource commands. With IWSM there is a single manager totally responsible for providing that capability. IWSM enhances "support to the operational commands and eliminates confusion about where system development and production ends and logistics support begins."(V:79)

Responsiveness to technical fusion opportunities. The two command structure of the past was "very good at putting new technology into new airplanes," but "not very good at putting new technology into old airplanes," according to Major General Ken Meyer, who led the transition team that raised the flag on the new AFMC.(S:59) The DoD budget forecast for the next few years indicates that if we are to improve our technological edge we better excel at inserting new technology into old airplanes. Current DoD acquisition strategy calls for improving the capability of existing weapon systems. This strategy has been supported by those in industry such as Mr. Norm Augustine, Chief Executive Officer of Martin Marietta, who recommended that highest priority be given to research and development so technical breakthroughs could be found and inserted into "old" programs or used in prototyping new ones.(I:163-4)

General Bill Tuttle, former commander of the Army Materiel Command stated that technology insertion on existing systems was much easier when an existing program manager and technical staff were already on a program. As an example he cited the Apache helicopter Target Acquisition Delivery System (TADS) and power train upgrades.

The IWSM single-manager concept should help eliminate some of the infighting that often occurs over whether to upgrade an old system or build a new one. These decisions in the current environment should be based on the best value for the money expended. A program manager responsible for all program aspects of an existing system should be in an excellent position to push technology insertion upgrades with a lot of specificity about what the costs and performance benefits will be. Lt. General Tom Ferguson, Commander of AFMC's Aeronautical Systems Center says the "circumstances we face today make the consideration of modifications more likely."(HH:42) He lists the A-10, F-15, F-16, F-117 and EF-111A as systems that could greatly benefit from upgrades.

The present opportunity and necessity to integrate new technology into existing aircraft is a current worldwide phenomenon that reflects the high cost of developing and fielding new aircraft. In Europe many upgrades to older aircraft are planned because "rapid technological advances in avionics and onboard armament can render obsolete the aircraft's weapon system in a few years."(KK:1587-93)

Visibility of Costs. In a more fiscally constrained budget environment "what is worth trying to do depends in large part on how much it costs."(CC) Having all aspects of programs managed by one program management team should increase the visibility of the total program life-cycle-costs. IWSM will provide this visibility of costs. However, cost control measures can only be effective if the

program manager is given the latitude to move funds between research and development, production, and support budgets to maximize the return on dollars invested in a program. This latitude has not been given and this limits the control a program manager can have over life-cycle-costs. (See Remaining IWSM Challenges - Funding and control of money.)

IWSM Implementation Process. Implementing IWSM with the focus on the core functions has kept AFMC energies directed at how best to accomplish the mission. With several separate programs given the latitude to work through the process, flexibility for individual program decisions has been protected in the short term and valuable knowledge for long-term core process refinements is being gathered.

Remaining IWSM Challenges

Funding and control of money. The sources and rules for using funds complicate a program managers capability to run a program efficiently. This area is a negative, not because it hasn't been aggressively pursued, but because it still isn't completely fixed. The goal is for a program manager to have control and spending authority for all aspects of her program. Some of the people I interviewed stated that this budget latitude was really needed by the IWSM teams -- especially in a period of compressed DoD budgets.

When the first IWSM teams were formed up to eleven separate funds were used to support various program requirements. The program manager only exercised some control over six of those funds. Funds for diverse activities such as research and development, procurement, interim contractor support, initial spares, replenishment spares, initial common support equipment, and capability modifications had

different spending rules and controls. Most of the money was not transferable between funds without action from higher management levels. The sustainment funds for replenishment spares and programmed depot maintenance work were controlled by the HQ Air Force logistics staff while research and development and procurement funds were controlled by the SECAF's acquisition staff.

A program manager's ability to control program costs will also be affected by Defense Management Report Decision 908 that "directs ALCs to be used at near 100 percent capacity" and to be open for competition from the other services and the commercial sector.(Y:51) Macro decisions to optimize the overall competitiveness and business volume at the ALCs could result in individual program inefficiencies.

Effective use of human resources. In 1986 the Packard Commission concluded that "lasting progress in the performance of the acquisition system **demands dramatic improvements** in our management of acquisition personnel at all levels within DoD.(DD:214) IWSM can only be effective if it helps unleash the potential of AFMC's people. While program teams now have all their key players in the same organization many things must be worked out before these teams enjoy harmonious relationships.

First, the program manager must truly be responsible for the entire team. Currently manpower resources to support a program are the "purview of the installation commander" -- normally the logistics or product center commander.(G:138) These senior officers could use this power to influence programs by placing key personnel in a program office -- personnel that have long-term allegiances to home functional offices that control their future jobs.

Second, underlying turf issues must be straightened out before teams will really play together. People on a team can't be fighting about who is responsible for what and still work together very productively. It will take time to build trust on a program by program basis until it eventually spreads through AFMC. If some individuals don't trust others in the program because they came from "the other command," or if old issues aren't resolved, then the program team will be unproductive.

Third, civilians who are assigned to Integrated Product Teams must be at the appropriate grade and skill level to give the program the technical expertise required. Currently civilian personnel regulations governing grade levels tie grade levels to the number of people supervised rather than the technical challenges faced by a program. Many of the front-end technical issues can be solved with a few senior "graybeards" working the issues rather than flooding the problem with a lot of inexperienced people.

Personnel ratings. The current system being developed provides for the system program director to be the primary rater for all personnel that work directly for her. This is probably as good a fix to the problems inherent in a dual rating chain as there is. With matrixed support and the product and logistics center commanders responsible for personnel support and ratings a real dichotomy exists. At the two star level a Program Executive Officer (PEO) really counts on a lot of personnel resources to execute programs -- personnel that work for her system program director; personnel she does not have direct control over.

Culture. The fundamental difference in the AFLC and AFSC cultures is currently the most serious drawback to the successful implementation of IWSM. In over 20 interviews I conducted with AFMC, HQ USAF, and SECAF personnel, culture was cited as the largest obstacle to IWSM. Even today, eight months since AFMC was formed the term "commodities" raises great furor in AFMC because it means something different to the former AFLC and to the former AFSC people.

The cultural merge is just beginning and won't be mature for several years. Grudges of AFLC people who have been burned trying to support unsupportable programs and AFSC people not understanding logistics functions are one source of other cultural difficulties. The fact that some AFLC people believe IWSM was just a method for AFSC to subsume AFLC is yet another source. However, the battles to protect jobs and organizational territory during a period of base closings and down-cycle of the DoD economy is the primary IWSM obstacle. One person I interviewed talked openly of turf battles going on over personnel assignments and over dollars. Many are worried about careers and job distribution between the product and logistics centers. This is especially intense when individuals are asked to team with others who are competing for their jobs!

It will likely take 5 - 10 years to mature an AFMC culture. This will occur as program successes and failures shape the AFMC style as mid- and upper-level leaders resistant to change move or retire, and as up cycles of the DoD budget provide a co-operative environment. One officer I interviewed says that even though the cultural gap is wide, IWSM has "made us talk to one another." Communication is certainly the first step in closing the gap!

Organizational structure. A program manager potentially could find herself in very uncomfortable political positions under IWSM. A decision on whether to put a depot in a contractor's facility or to use an existing logistics center could place her in an awkward position among the logistics center commander, who provides people depended upon to support the program; her PEO, who is looking for the best value for sustainment activities; her product center commander; the Air Force Acquisition Executive and the AFMC commander. Most program managers will have to count on all of them for support.

The potential for conflict with ALC commanders is especially high since they are responsible "for efficient, effective management of the organic Depot Maintenance resources (manpower, facilities, equipment, funds) located at their centers."(G:85)

From the sustainment side she must satisfy two chains of command within the Pentagon. The logistics staff (LG) controls her long-term sustainment dollars and the acquisition staff (AQ) controls her acquisition dollars. Although program management directives (PMDs) for programs must be coordinated on by both LG and AQ, without the program management staff's active involvement they will likely be disconnected. Although efforts are underway to resolve this problem it's not fixed yet.(G:40)

In essence the support structure from on high could play havoc with a program office. Many of the people I interviewed cited continued disconnects in the PMDs and the AQ - LG chasm as causing many problems for the program teams. Its tough for a program team to deal with a seam at the top! The program manager must contend with multiple senior leaders, many of whom have authority to render decisions that can be very detrimental to a program office's capability to get the job done. As one source said, "the

colonels and generals are still trying to make all the decisions in what should be a decentralized decision-making process."

Mission area integration. The mission area analysis currently conducted does not evaluate the mission area as such but only focuses on systems within that mission area. This type of integration was demonstrated vividly on "17 Jan 1991, day one of Operation Desert Storm."(NN:4-13) After the Turkish government granted border crossing authority the 7440th **Composite Wing** launched a 20 ship package from Incirlik Air Base, the first of many such launches that placed many different aircraft (F-15s, F-16s, F-4Gs, EF-111s, E-3Bs, EC-130s and F-111s) in the sky working together. It worked well because most of the pilots had flown similar missions before at **integrating exercises** such as Red Flag. However, with a structured analysis of entire mission areas the integration required among systems can occur in research and development and enhance performance even more. We haven't begun to approach the technological potential!

Probably the most cost effective method to handle this deficiency is through modeling of the theater and mission environments. One such battlefield management simulation modeling approach is the War Breaker program being developed through the Advanced Research Projects Agency (ARPA).(EE:5-7) Use of this type of modeling to determine which system approaches can best accomplish wartime missions is needed for much improved mission area analysis. Creation of the synthetic environments is one of the seven technology thrust areas pushed by DoD last year.(O:4) It is also compatible with the new proposed acquisition strategy that relies on high investment in research and development, roll-over plus, silver bullet procurements, and just-in-time weapons.(FF:38-9)

As Jacques Gansler points out, national debates about military preparedness and requirements usually center around how much the defense budget should be changed or about gross amounts of military systems like a "600 ship Navy." He goes on to state that "these solutions are very poor substitutes for in-depth analysis on a mission-by-mission and program-by-program basis."(H:65-6) Without an operational analysis that generates mission area requirements the IWSM concept for integrating between weapon systems can't be accomplished. The broad mission area requirements are needed so specific requirements can be flowed down to existing systems for upgrades or for new weapon development.

Software, electrical and mechanical interfaces should also be standardized so weapons can more easily be adapted to aircraft and new aircraft can more easily be paired with existing weapons. The MIL-STD-1760 interface which defines the aircraft/weapon electrical and information interfaces should be continually updated and used for systems in development. Guidance for tradeoffs should be provided.

Concept Validation Summary

Six characteristics were postulated in the recent book Made in America as being similar among the best-practice firms:(D:118)

(1) a focus on simultaneous improvement in cost, quality, and delivery;
(2) closer links to customers;
(3) closer relationships with suppliers;
(4) the effective use of technology for strategic advantage;
(5) less hierarchical and less compartmentalized organizations for greater flexibility; and
(6) human-resource policies that promote continuous learning, teamwork, participation, and flexibility.

Points 1, 2, 3, 4, and 5 are all strongly supported by the IWSM process and were previously discussed. Point 6 gets a mixed review since weapon system program managers don't have full control of the

human resources assigned to their program the way IWSM is being implemented. Specifically, senior officers outside a system program director's chain of command can control the final ratings and some promotions of the people they count on to help their program succeed.

Ultimately the best judge of IWSM will be the AFMC customers -- the weapon system users. If IWSM helps provide users with more supportable and affordable weapon systems that increase their combat capability, then IWSM will accomplish what it was designed to do.

WHERE DO WE GO FROM HERE?

Following are 9 recommendations to improve IWSM:

1. Continue to refine the IWSM philosophy and eight core processes. Provide a core IWSM architecture but resist the temptation to enforce standardization of the processes.

2. Form AFMC repositories for vital information and lessons learned that can help a program successfully implement IWSM.

3. Determine what HQ AFMC's, product centers', logistics centers' and individual program managers' responsibilities are for maintaining the industrial base. Refine the IWSM processes accordingly.

4. Continue refining the AFMC expanded support structure and developing needed centers of expertise that will help program teams successfully handle extraordinary problems that don't merit having resident expertise in program offices.

5. Provide the program manager more control of the ratings and individual annual awards for all people assigned to the program. Modify the rating form to provide a comment block for the functional home office if they want to take issue with or add information to a rating.

6. Develop decision support information systems that link geographically separated elements of a program office.

7. Capture the knowledge of the IWSM experts to mold what the process should be for new program starts.

8. After each favorable milestone decision or at other determined major transition points for a program update the manpower resources agreement between the program manager and all other AFMC offices that need to provide her personnel resources support through the next milestone.

9. Continue emphasis on clearly defining and tasking integration responsibilities, avoiding overlap and encouraging cooperation between program offices. The Weapon Systems Reviews between aircraft and weapon program offices and the Weapon Integration Plans being conducted by AFMC's Aeronautical Systems Center greatly aid difficult integration tasks and the concept should be extended to other integration activities as well.

ADAPTATION TO JOINT PROGRAMS

Applying the IWSM concepts to managing joint programs brings an extra challenge. The major problem comes on the front end of the program when requirements are generated. It is here that a large potential for a breakdown in seams occurs. If each of the services has unique requirements levied on a program, potential conflicts in system capabilities and tradeoffs among competing requirements occur. The executive service for a program must keep all the future users engaged in any tradeoff decisions (1) to ensure that support issues are worked out, (2) to avoid needless picking up of long-term costs by loading a program with requirements that may become obsolete, and (3) to keep the confidence of the other services that their best interests are being served.

General Tuttle recommended that the lead service make sure the other using service(s) have ample opportunity to influence the program design. Then he suggested that they sign up to a program requirements baseline. He also stressed the importance of keeping the focus on the support, training and testing issues early in a joint program.(GG)

This integrated product development should be expected to take longer for a joint program. Recognition that many competing requirements must be folded together will save time and a lot of money later in the program. Operational studies, trade-off analyses

and technical evaluations need to be played off against one another with all users involved so requirements can be reconciled. An Integrated Weapon System Master Plan (IWSMP) should then capture the program baseline with all users, the joint program office and other affected parties signed up to that baseline. OSD should also play in this process and determine a priority for the users so the program manager is in a better position to make the tradeoffs.

The AMRAAM program provides an example of what can happen when requirements become blurred. Somehow the Navy requirement for carrier landings and the Air Force requirement for a 2000 hour carriage life got confused. An OSD "requirement" was generated that forced the AMRAAM program to show that AMRAAM could sustain a 2000 hour carriage life in a Navy carrier-landing environment. Millions of dollars were spent meeting this unnecessary requirement!

EVALUATION CRITERIA FOR ACQUISITION MANAGEMENT SYSTEMS

I recommend the following criteria for use in evaluating the effectiveness of acquisition management processes:

1. Responsiveness to users requirements.
2. Efficiency in converting resources into capability.
3. Effectiveness in integrating new capability into the existing infrastructure supporting its mission area.
4. Control and management of weapon system sustainment costs.
5. Provision for long-term considerations, especially the opportunity to upgrade existing systems with new technology.
6. Capability to provide strength for the future industrial base.
7. Effectiveness of the management system to influence the organizational culture over a long period of time.
8. Compatibility with trends in industry -- the suppliers we depend on to provide new weapon systems.
9. Consistency with current U.S. national security strategies.

COLORING IWSM PURPLE

The current drawdown of resources available to equip U.S. military units has given rise to many questions concerning how to accomplish weapon systems acquisition more efficiently. Gansler argues that "the American military services will achieve synergism only through an integrated approach to resource planning and war-fighting, and not through their independent capabilities."(H:76) People charged with the responsibility to organize our acquisition process may soon conclude that we can no longer afford the luxury of separate service acquisition organizations. My objective here is not to debate the pros and cons of a "purple suit acquisition corps" but rather to provide some thoughts about how the IWSM concepts could be appropriately applied in such an organization.

The goals and objectives of IWSM are admirable. Regardless of the future structure of the DoD acquisition system, the key tenets of IWSM should be adopted. Having one team responsible for a program from cradle to grave seems to be the best way to ensure the costly integration errors of the past aren't repeated! General Tuttle stated that the IWSM concepts seem very appropriate for a joint acquisition command but stressed that in a joint acquisition environment there would be a greater need to engage each of the affected services in the system requirements and design stages.(GG)

This is where they can have the most influence in affecting the characteristics of the system and how supportable it will be. General Tuttle also recommended that each of the buying services retain control of the sustainment funds for the system -- even if that service didn't own the support contract or logistics center.

Concerns about how a purple suit acquisition environment would impact implementing the IWSM concepts include:

- Inherent danger in getting too far removed from the users and being out of touch with their requirements.
  -- Contractors may position themselves between the users and the acquisition command program teams, offsetting the balance within the military services.
  -- Layers of bureaucracy may obscure program managers from the users, violating the "single face to the user" tenet.
- Too much distance between the program office and the user(s) would also make the cost, performance, schedule and supportability tradeoff process less effective. This distance is not merely physical separation, but could also be in cultures, influence, or bureaucracy.
- One of the current proposals would have a separate joint depot command which conceivably would control all the support and sustainment functions of the services. This organizational structure would directly subvert the cradle-to-grave, single-face-to-the-user, seamless processes, and integrated product team concepts!
  -- A reorganization of this type must be challenged on its capacity to comply with the ideals that IWSM has captured.

Implementing IWSM in a DoD acquisition command should help decrease the number of overlapping requirements that exist from redundant programs and from having separate acquisition and sustainment personnel working the same program. Sustainment budgets and acquisition budgets could be adjusted to provide program managers the chance to react quickly to technology insertion opportunities that would result in either decreased sustainment costs or increased weapon system capability.

CONCLUDING THOUGHTS

IWSM is an effective management philosophy for AFMC. It still needs time to mature. Future refinement of the core acquisition processes and the AFMC culture will determine IWSM's effectiveness.

A lot of the trappings of the old AFSC and AFLC cultures are caught up in the product and logistics centers. I believe the power that still resides there in the center commanders and functional directors must migrate toward the IWSM program offices if IWSM is going to work as it should. The logistics and product centers still have a strong bureaucratic stranglehold over programs. The changing

conditions in industry and the emerging DoD acquisition strategy call for program teams to have as much flexibility as possible to respond to the opportunities and demands their programs will face. This means that the functional staffs at AFMC, HQ USAF and SECAF must support the emerging IWSM culture by viewing themselves as the facilitators of program team goals.

Some of the current roadblocks that prevent us from focusing on the real mission of AFMC -- getting the most capable systems to the operators at affordable life cycle costs -- is hampered by focusing on jobs and arguing about who has control. In a time of decreased resources this is natural, but AFMC must continue to refocus on how the IWSM developing processes and AFMC interrelationships allow the program managers, commodity managers and materiel managers to accomplish their missions. This is the core purpose of AFMC.

Perhaps one program manager put it best. He said that "IWSM is all about teambuilding and trust." The extent to which AFMC works toward building teams and trust will determine IWSMs success.

EPILOGUE

On 27 December 1992 at 10:20 A.M. Iraqi time a pilot flying an F-16 from Shaw AFB, South Carolina, shot the first AMRAAM ever fired in combat.(QQ:4) A few seconds later an MIG-25 Foxbat was destroyed, presumably becoming a timeless tomb for an unprepared enemy pilot who unluckily was flying in an aircraft that lacked the sophisiticated integration that married a lethal weapon with a potent platform. Our integration worked again! The F-16, integrated with AMRAAMs, had been transformed into an all weather fighter with greatly increased combat capability.

The F-16 was the second aircraft to be paired with AMRAAM. The numerous hard hours of integration work that had brought so much tension to a Florida morning in May 1990 were richly rewarded in Iraqi skies half a world away less than 3 years later. The IWSM philosophy and people who implement it will have the opportunity to repeat similar integration feats many times over!

ENDNOTES

A. Brown, Susan D. "4 v. 4: AMRAAM tracks four targets, scores near simultaneous kills," Leading Edge (June 1990), p. 15.

B. Kitfield, James. "Curtain Up on Materiel Command," Air Force Magazine (August 1991), pp. 66-69.

C. Bowman, Rich. "Integrated Weapon System Management," AFMC/XR-WS briefing in the Pentagon, January 26, 1993.

D. Dertouzos, Michael L., Lester, Richard K. and Solow, Robert M. Made in America. New York: HarperCollins Publishers. 1990.

E. Reich, Robert B. The Work of Nations. New York: Random House Inc. 1992.

F. Ferguson, Lt. Gen. Thomas R. Letter dated 27 August 1992 to Mr. Jerry Schmidt, Chairman Commodity Working Group.

G. Department of the Air Force. AFLC/AFSC/AFCC/AFMC Pamphlet 800-60, IWSM Guide. May 29, 1992.

H. Gansler, Jacques S. Affording Defense. Cambridge, Mass: The MIT Press. 1991.

I. Adelman, Kenneth L. and Augustine, Norman R. The Defense Revolution. San Francisco: ICS Press. 1990.

J. A White Paper titled "Integrated Weapon System Management in Air Force Materiel Command," signed by General Ronald W. Yates and General Charles C. McDonald. January 28, 1992.

K. "Clinton on Defense: Retain Superior Technology," Defense Electronics (October 1992), pp. 21-23.

L. National Security Strategy of the United States. Washington D.C.: The White House. January 1993.

M. A White Paper titled "Defense Acquisition" attached to a memorandum titled "Defense Acquisition" from Mr. Don Yockey, Under Secretary of Defense (Acquisition) to several defense department offices. Memorandum dated 20 May 1992.

N. A White Paper titled "Defense Industrial Base" attached to a memorandum titled "Defense Acquisition" from Mr. Don Yockey, Under Secretary of Defense (Acquisition) to several defense department offices. Memorandum dated 20 May 1992.

O. A White Paper titled "Defense Science and Technology Strategy" attached to a memorandum titled "Defense Acquisition" from Mr. Don Yockey, Under Secretary of Defense (Acquisition) to several defense department offices. Memorandum dated 20 May 1992.

P. Aspin, Rep. Les. "Tomorrow's Defense From Today's Industrial Base: Finding the Right Resource Strategy For A New Era," February 26, 1992.

Q. Hanzhang, General Tao. Sun Tzu's Art of War: The Modern Chinese Interpretation. Translated by Yuan Shibing. Brentwood, N.Y.: Interstate Litho. 1990.

R. Clausewitz, Carl von. On War Ed. and translated by Michael Howard and Peter Paret. Princeton, N.J.: Princeton University Press. 1976.

S. Bond, David F. "Military Budget Drawdown Spurs Movement Toward Increased Efficiency," Aviation Week and Space Technology (December 9, 1991), pp. 58-59.

T. Fulghum, David A. "Materiel Command Headquarter Opens To Ease USAF Relations With Contractors," Aviation Week & Space Technology (May 6, 1991), p. 64.

U. "Air Force Systems Command," Air Force Magazine (May 1991), p. 76-79.

V. McDonald, General Charles C. "Beyond R&M 2000," Air Force Magazine (November 1991), pp. 54-58.

W. "U.S. Infrastructure: Where Have All the Dollars Gone?," Focus, National Center for Manufacturing Sciences (June 1991), pp. 1-8.

X. "Integrated Weapon System Management: Cornerstone of Air Force Materiel Command," United States Air Force Fact Sheet. AFLC and AFSC Office of Public Affairs. February 1992.

Y. Grier, Peter. "The Other Industrial Base," Air Force Magazine (July 1992), pp. 50-52.

Z. Rice, Donald B. "Delegation of Authority for Sustainment and Continued Readiness," Memorandum sent to SAF/AQ and AF/LG. August 13, 1992.

AA. Green, Brian. Contributing Ed., "Helping Industry Convert," Air Force Magazine (July 1992), p. 8.

BB. Opstal, Debra van "Integrating Commercial and Military Technologies for National Strength," The Center for Strategic & International Studies Report (March 1991), pp. i-xvii.

CC. Enthoven, Alan C. and K. Wayne Smith, "New Concepts and Tools to Shape the Defense Program," Defense Requirements and Resource Allocation William McNaught, ed. Washington D.C.: NDU Press. 1989.

DD. Fox, Ronald J. The Defense Management Challenge: Weapons Acquisition. Boston: Harvard Business School Press. 1988.

EE. Berry, F. Clifton Jr. "War Breaker: Lever of Power," National Defense (December 1992), pp. 5-7.

FF. Cochrane, Charles B. "DoD's New Acquisition Approach: Myth or Reality," Program Manager (July-August 1992), pp. 38-46.

GG. Interview on 16 Feb. 1993 with General (ret.) William Tuttle, former Commander of the Army Materiel Command and now President of LMI.

HH. Oliveri, Frank Ass. Ed., "Upgrading the Fighter Fleet," Air Force Magazine (July 1992), pp. 42-47.

II. "Additional Guidance for AFMC IWSM Process Development," Memorandum of Agreement signed by General Charles C. McDonald and General Ronald W. Yates on 25 June 1991.

JJ. "AFMC IWSM Process Development Roadmap II," 31 December 1991.

KK. Salvy, Robert "Updating older combat aircraft," International Defense Review, Volume 21 (December 1988), pp. 1287-1293.

LL. "Integrated Weapon System Management (IWSM) Model for Single Managers in AFMC," AFMCR 500-11. 1 November 1992.

MM. "Reaching Globally, Reaching Powerfully: The United States Air Force in the Gulf War," Department of the Air Force Report (Sept. 89).

NN. "Aircraft/Weapon Integration: CPT Report," Aeronautical Systems Division briefing given on 15 June 1992.

OO. Mackin, Jere Gene "Integration of New Weapon Systems into Existing Ship Classes: An Orderly Approach," Defense Systems Management College Report for Program Management Class 77-1, August 17, 1977.

PP. Downer, Brig. Gen. Lee A. "The Composite Wing in Combat," Airpower Journal (Winter 91), pp. 4-16.

QQ. "Coverage of Iraqis 'no fly' zones increase," Air Force Times January 11, 1993.

RR. "Integrated Product Teams a Key to Future Contracts," Defense Daily (Volume 177, No. 128), November 10, 1992.